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(54) WAVE RESISTANCE LARGE FLOATING BODY

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce oscillation over a wide wave period of range and even in a high wave by arranging a plate extending downward from the bottom surface of a large floating body with penetrating through the water surface and a breakwater member having a submerged horizontal plate extending forward from a lower end part of the plate in a wave upper side front end part of the large floating body.

SOLUTION: For example, a steel plate breakwater member 4 is fixed as a wave resistant structure over the whole width of a large floating body 1 to a wave upper side front end part 1a of the large floating body 1. The breakwater member 4 is constituted in an almost L shape out of a vertical plate 5 as a plate extending downward from the bottom surface 1b of the large floating body 1 by penetrating through the water surface and a submerged horizontal plate 6 as a submerged plate integrally extending forward from a lower end part of the vertical plate 5. When a wave enters from the wave upper surface in a state of being floated on the water, fluctuating pressure applied to the submerged horizontal plate 6 of the breakwater member 4 and fluctuating pressure applied to the bottom surface of a front end part 1a of the large floating body 1 become an antiphase to offset each other. Thus, pressure integral value of a wave acting on the front end part of the large floating body 1 becomes

small to reduce oscillation.

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1]A wave-proof type large-sized floating body characterized by providing a suppression-of-waves member which has a **** horizontal plate ahead prolonged from a plate which penetrates the water surface to a wave upper part front end part of said large-sized floating body, and is caudad prolonged from the bottom of a large-sized floating body in it, and a lower end part of this plate in a wave-proof type large-sized floating body floating on water surface.

[Claim 2]A wave-proof type large-sized floating body characterized by providing a suppression-of-waves member which has a **** ramp of a declivity toward the front from a plate caudad prolonged from the bottom of a large-sized floating body which penetrates the water surface in a wave-proof type large-sized floating body floating on water surface to a wave upper part front end part of said large-sized floating body, and a lower end part of this plate.

[Claim 3]The wave-proof type large-sized floating body according to claim 1 or 2, wherein said large-sized floating body has an extended deck which extends to the wave up side and connects between front end parts of a front end part of this extended deck, said **** horizontal plate, or a **** ramp so that water flow is possible.

[Claim 4]A wave-proof type large-sized floating body characterized by providing a suppression-of-waves member which has a **** board back prolonged from a plate which estranges with a front end surface of a large-sized floating body to a wave upper part front end part of said large-sized floating body, penetrates the water surface to it, and is caudad prolonged from the bottom of a large-sized floating body in it, and a lower end part of this plate in a wave-proof type large-sized floating body floating on water surface.

[Claim 5]Said large-sized floating body connects an upper bed part of a plate which has an extended deck which extends to the wave up side, penetrates a front end part and the water surface of this extended deck, and is caudad prolonged from the bottom of a large-sized floating body, The wave-proof type large-sized floating body according to claim 4 connecting between a wave upper part front end pars basilaris ossis occipitalis of said large-sized floating body, and rear end parts of a **** board so that water flow is possible.

[Claim 6]The wave-proof type large-sized floating body according to claim 3 or 5, wherein a member

connected so that said water flow is possible is a reticulate member, a perforated plate, a slit plate, or a lattice member.

[Claim 7]The wave-proof type large-sized floating body according to claim 1, wherein an opening penetrated to a sliding direction is provided in said **** horizontal plate.

[Claim 8]The wave-proof type large-sized floating body according to claim 4 or 5, wherein an opening penetrated to a sliding direction is provided in said **** board.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the wave-proof type large-sized floating body which reduces that the large-sized floating body structure (henceforth a Mega-Float) which appears on the sea, a floating pier, ******, etc. are shaken by an incident wave.

[0002]

[Description of the Prior Art]Development of the Mega-Float which appears on the sea is furthered. The Mega-Float considered conventionally is a floating body structure of a core box which builds calm ocean space with a stationary type breakwater to ocean space, and is installed into it.

Two or more sealed float rooms were established in the inside, and it has a flat deck and the flat bottom.

[0003]Therefore, on an offshore airport (an offshore heliport is included), a sea plant barge, and a future target, the marine city of a Mega-Float etc. are multiple-purpose.

[0004]Drawing 15 is the Mega-Float provided with the stationary type breakwater.

The large-sized floating body e is floated on this calm ocean space c, construct the stationary type breakwater b to the seabed a, and the calm ocean space c is built, and the mooring pile d is formed so that it may be surrounded, and the large-sized floating body e is moored via the buffer member f.

The large-sized floating bodies e are 500 m in 1500 m in length, and width, 7 m in thickness, and 2 m in draft, for example.

Compared with length, it is the structure where thickness is thin.

[0005]And when a wave direction, a wave period, and the flexural rigidity of the large-sized floating body e were changed systematically and elastic response analytical calculation in a billow was performed with the depth of water of 20 m, it became clear that at least 2 m had the severe marginal wave height on a design.

[0006]A Mega-Float which ends even if it becomes coming alongside the quay of a marine vessel and the obstacle of handling work for the stationary type breakwater b to require immense expense for installation if depth of water becomes deep, and to form a floating breakwater instead of the stationary type breakwater b and it does not have the stationary type breakwater b and a floating breakwater is desired.

[0007]In order to make it materialized without the stationary type breakwater b and a floating breakwater in consideration of losing the influence on cost, a marine vessel, etc., it is necessary to take the measures

against agitation reduction against the large-sized floating body e itself, and to raise wave-proof performance. First, in order to reduce the incident wave to the large-sized floating body e as a method, it was possible to add a wave absorbing structure object to the wave upper part of the large-sized floating body e, and as shown in drawing 16, the wave absorbing structure object g was fixed to the wave upper part front end part h of the large-sized floating body e in the former.

[0008]As the conventional wave absorbing structure object g, you reflect a wave, or make it scattered about, and it thinks using mechanisms, such as crushing, and the curtain wall type shown in drawing 17 (a), the tank opening plate type shown in the figure (b), the beach type shown in the figure (c), etc. are known.

[0009]

[Problem(s) to be Solved by the Invention]Only the short wavelength region of the curtain wall type mentioned above is effective, and since a tank opening plate type and a **** beach type break down a wave gradually or are made to **** it, they are effective to a long wavelength field. However, in order to acquire sufficient suppression-of-waves effect, according to remarkable length and the experiment, the 1/3rd place is required to wavelength. Therefore, 70-m [80] length are needed in it being 200 m in wavelength temporarily, and a wave absorbing structure object is enlarged and it becomes a cause of a cost hike.

[0010]The place which this invention was made paying attention to said situation, and is made into that purpose, It is in providing the wave-proof type large-sized floating body which can suppress waves efficiently and can reduce agitation also in a wide range wave period and a high wave by the suppression-of-waves member of an easy structure provided in the large-sized floating body without installing a stationary type breakwater etc.

[0011]

[Means for Solving the Problem]In order that this invention may attain said purpose, claim 1, In a wave-proof type large-sized floating body floating on water surface, a suppression-of-waves member which has a **** horizontal plate ahead prolonged from a plate which penetrates the water surface and is caudad prolonged from the bottom of a large-sized floating body, and a lower end part of this plate was provided in a wave upper part front end part of said large-sized floating body.

[0012]If a wave advances from the wave upper part in the state where it floated on water surface according to claim 1, so that it may explain in full detail behind, Since fluctuating pressure (value which lengthened a pressure applied to the upper surface from a pressure concerning the undersurface of a **** horizontal plate) concerning a **** horizontal plate of a suppression-of-waves member, and fluctuating pressure concerning the front end part bottom of a large-sized floating body become an opposite phase and offset each other mutually, A pressure integral value (wave legal force) of a wave which acts on a large-sized floating body front end part becomes small, and agitation can be reduced.

[0013]In a wave-proof type large-sized floating body floating on water surface, claim 2 provided a suppression-of-waves member which has a **** ramp of a declivity toward the front from a plate which penetrates the water surface and is caudad prolonged from the bottom of a large-sized floating body, and a lower end part of this plate in a wave upper part front end part of said large-sized floating body.

[0014]If a wave advances from the wave upper part in the state where it floated on water surface according to claim 2, so that it may explain in full detail behind, Since fluctuating pressure (value which lengthened a pressure applied to the upper surface from a pressure concerning the undersurface of a rejection horizontal

plate) concerning a rejection horizontal plate of a suppression-of-waves member, and fluctuating pressure concerning the front end part bottom of a large-sized floating body become an opposite phase and offset each other mutually, a pressure integral value (wave legal force) of a wave which acts on a large-sized floating body front end part becomes small, and agitation can be reduced.

[0015]Claim 3 has an extended deck which extends to the wave up side, and connected said large-sized floating body of claim 1 or 2 so that water flow of between front end parts of a front end part of this extended deck, said **** horizontal plate, or a **** ramp was possible.

[0016]According to claim 3, deck area of a large-sized floating body becomes large, it is utilized effectively, and a marine vessel etc. are prevented from colliding with a rejection horizontal plate ahead of a large-sized floating body.

[0017]In a wave-proof type large-sized floating body floating on water surface, claim 4 penetrated the water surface to a wave upper part front end part of said large-sized floating body, estranged to it with a front end surface of a large-sized floating body, and provided in it a suppression-of-waves member which has a **** board back prolonged from a plate caudad prolonged from the bottom of a large-sized floating body, and a lower end part of this plate.

[0018]If a wave advances from the wave upper part in the state where it floated on water surface according to claim 4, so that it may explain in full detail behind, Since fluctuating pressure (value which lengthened a pressure applied to the upper surface from a pressure concerning the undersurface of a rejection horizontal plate) concerning a rejection horizontal plate of a suppression-of-waves member, and fluctuating pressure concerning the front end part bottom of a large-sized floating body become an opposite phase and offset each other mutually, a pressure integral value (wave legal force) of a wave which acts on a large-sized floating body front end part becomes small, and agitation can be reduced.

[0019]Said large-sized floating body of claim 4 has an extended deck which extends to the wave up side, and connected an upper bed part of a plate which penetrates a front end part and the water surface of this extended deck, and is caudad prolonged from the bottom of a large-sized floating body, and claim 5 connected between a wave upper part front end pars basilaris ossis occipitalis of said large-sized floating body, and rear end parts of a **** board so that water flow was possible.

[0020]According to claim 5, area of a deck of a large-sized floating body is expanded by extended deck.

[0021]Claim 6 is characterized by a member connected so that said water flow of claim 3 or 5 is possible being a reticulate member, a perforated plate, a slit plate, or a lattice member. In this case, it is crushed when an incident wave passes a water-flow-resistance member further, and billow energy declines.

[0022]An opening which penetrates claim 7 to said **** horizontal plate of claim 1 in a sliding direction is provided.

[0023]An opening which penetrates claim 8 to said **** board of claim 4 or 5 in a sliding direction is provided.

[0024]

[Embodiment of the Invention]Hereafter, each embodiment of this invention is described based on a drawing.

[0025]Drawing 1 and drawing 2 show a 1st embodiment. Drawing 1 and drawing 2 show the large-sized floating body 1 which constitutes a megafloat (henceforth a Mega-Float), and, as for this large-sized floating body 1, two or more float rooms (not shown) which constituted in rectangular parallelepiped shape with the

steel plate, and were sealed inside are provided, for example. And the large-sized floating body 1 is appearing on the sea with the lift which a float room generates. 2 shows the waterline of the large-sized floating body 1, and 3 shows direction waves.

[0026]The overall width of the large-sized floating body 1 is covered in the wave upper part front end part 1a of the large-sized floating body 1, and the suppression-of-waves member 4 as [made from a steel plate] a wave-proof structure (for example, a product) is fixed. This suppression-of-waves member 4 is constituted from the lamina perpendicularis 5 as monotonous which penetrates the water surface and is caudad prolonged from the bottom 1b of the large-sized floating body 1, and the **** horizontal plate 6 as a rejection horizontal plate prolonged ahead (on a wave) from the lower end part of this lamina perpendicularis 5 at one by the abbreviated L type. Said lamina perpendicularis 5 may incline forward and backward somewhat. About the portion to which this lamina perpendicularis 5 laps with the front end board of the large-sized floating body 1, it is also possible to substitute a front end board, and the meaning is the same although it seems that the lamina perpendicularis 5 has hung from the undersurface of the large-sized floating body 1 in that case.

[0027]On the same flat surface as the deck 1c of the large-sized floating body 1, the extended deck 7 which extends at a level with the wave upper part is formed, by the lamina perpendicularis 5 and the **** horizontal plate 6, it is constituted by the approximately U shape and the opening 8 is formed in the front end part at the upper bed part of the lamina perpendicularis 5. And the member 9 which was fixed to the front end part of the extended deck 7 and the front end part of the **** horizontal plate 6 and which it can let flow is formed in this opening 8. The member 9 in which this water flow is possible is the support, the reticulate member, the perforated plate, slit plate, or lattice member allocated by the suitable space, and passes through sea water.

[0028]According to the large-sized floating body 1 provided with the suppression-of-waves member 4 constituted as mentioned above, in the state where it floated on water surface. Since the fluctuating pressure (value which lengthened the pressure applied to the upper surface from the pressure concerning the undersurface of the **** horizontal plate 6) concerning the **** horizontal plate 6 of the suppression-of-waves member 4, and the fluctuating pressure concerning the bottom of the front end part 1a of the large-sized floating body 1 will become an opposite phase and will offset each other mutually, if a wave advances from the wave upper part, The pressure integral value (wave legal force) of the wave which acts on the front end part of the large-sized floating body 1 becomes small, and agitation can be reduced.

[0029]And to wavelength, supposing it is effective by about 1/10 length and wavelength is 200 m, about [20m] length is enough, the miniaturization of the suppression-of-waves member 4 can be attained, and a cost cut can be aimed at.

[0030]In this embodiment, if the member 9 which can let water flow is constituted from a reticulate member, a perforated plate, a slit plate, a lattice member, etc., an incident wave is crushed when passing the member 9 which can let water flow, billow energy decreases it, and it can reduce the influence of the incident wave of the large-sized floating body 1 containing the suppression-of-waves member 4.

[0031]In this embodiment, since the extended deck 7 is established in the suppression-of-waves member 4, the area of the deck 1c of the large-sized floating body 1 can be expanded, and there is an effect which prevents a marine vessel etc. colliding with the **** horizontal plate 6. However, the direct action of the

extended deck 7 may not be carried out to a suppression-of-waves operation, and it may be omitted. Namely, what is necessary is just L mold structure to which the suppression-of-waves member 4 becomes a suppression-of-waves performance target from the lamina perpendicularis 5 and the **** horizontal plate 6.

[0032]Drawing 3 is a graph which shows the relation between the distance from the front end (on a wave) of a large-sized floating body, and the fluctuating pressure amplitude distribution added to a large-sized floating body. Among a graph, (x) is a large-sized floating body which does not have a suppression-of-waves member, and (O) is the large-sized floating body 1 provided with the suppression-of-waves member 4 of the L type of this invention. (The minus portion of a horizontal axis is a suppression-of-waves member) The thing of only a large-sized floating body decreases gradually as a big pressure is added to the front end and it separates from the front end, but they are few so that clearly from this graph. It turns out that the pressure by which the large-sized floating body 1 provided with the suppression-of-waves member 4 of an L type is added to the front end of the large-sized floating body 1 although a big pressure is added to the suppression-of-waves member 4 becomes about 1/2. Drawing 4 is the graph which showed the phase distribution of pressure fluctuation, and it turns out that the phase of the pressure fluctuation of the large-sized floating body 1 and the suppression-of-waves member 4 is reversed.

[0033]Drawing 5 is what showed the pressure integral value from the front end of the large-sized floating body 1 to 50 m on a wave period basis, Since the fluctuating pressure (value which lengthened upper surface pressure from the undersurface pressure of the **** horizontal plate 6) concerning the **** horizontal plate 6 of the suppression-of-waves member 4, and the fluctuating pressure concerning the front end part bottom of the large-sized floating body 1 become an opposite phase and offset each other mutually, It turns out that especially the pressure integral value (wave legal force) added to large-sized floating body 1 front end part sets in a long period side, and falls substantially.

[0034]Drawing 6 shows a 2nd embodiment, and the 1st embodiment and identical configuration portion attach the same number, and omit explanation. The inclination type suppression-of-waves member 11 of this embodiment comprises the **** ramp 13 of the declivity toward the front from the lower end part of the lamina perpendicularis 12 which penetrates the water surface to the wave upper part front end part 1a of the large-sized floating body 1, and is caudad prolonged from the bottom 1b of the large-sized floating body 1 in it, and this lamina perpendicularis 12.

[0035]According to the large-sized floating body 1 provided with the suppression-of-waves member 11 of this embodiment, in the state where it floated on water surface. Since the fluctuating pressure (value which lengthened the pressure applied to the upper surface from the pressure concerning the undersurface of the **** ramp 13) concerning the **** ramp 13 of the suppression-of-waves member 11, and the fluctuating pressure concerning the bottom of the front end part 1a of the large-sized floating body 1 will become an opposite phase and will offset each other mutually, if a wave advances from the wave upper part, The pressure integral value (wave legal force) of the wave which acts on large-sized floating body 1 front end part becomes small, and agitation can be reduced.

[0036]Drawing 7 shows a 3rd embodiment, and the 1st embodiment and identical configuration portion attach the same number, and omit explanation. The lamina perpendicularis 15 which the suppression-of-waves member 14 of the reverse L type of this embodiment hangs from the front end part

of the extended deck 7 which extends toward the wave upper part from the wave upper part front end part 1a of the large-sized floating body 1, estranges with the front end surface of the large-sized floating body 1, and is caudad prolonged from the bottom 1b of the large-sized floating body 1, It comprises the **** board 16 back prolonged from the lower end part of this lamina perpendicularis 15. And the member 17 which can let water flow is formed between the rear end part of the **** board 16, and the lower end corner of the front end part 1a of the large-sized floating body 1.

[0037]In therefore, the state where it floated on water surface according to the large-sized floating body 1 provided with the suppression-of-waves member 14 of this embodiment. Since the fluctuating pressure (value which lengthened the pressure applied to the upper surface from the pressure concerning the undersurface of the **** board 16) concerning the **** board 16 of the suppression-of-waves member 14, and the fluctuating pressure concerning the bottom of the front end part 1a of the large-sized floating body 1 will become an opposite phase and will offset each other mutually, if a wave advances from the wave upper part, The pressure integral value (wave legal force) of the wave which acts on large-sized floating body 1 front end part becomes small, and agitation can be reduced.

[0038]In this embodiment, it may be the shape bent right-angled from the lower end of the lamina perpendicularis 15, and although the **** board 16 prolonged back was formed, it may be the structure which projects the lower end part of the lamina perpendicularis 15 caudad from the undersurface of the **** board 16.

[0039]Drawing 8 shows a 4th embodiment, and the 1st embodiment and identical configuration portion attach the same number, and omit explanation. In this embodiment, the aperture width 6c is formed in the middle of the **** horizontal plate 6. That is, the **** horizontal plate 6 has composition which connected the backside horizontal plate 6a fixed to the lower end of the lamina perpendicularis 5, and the front side horizontal plate 6b formed by separating this and the aperture width 6c with the suitable space.

[0040]Drawing 9 shows a 5th embodiment, and the 3rd embodiment and identical configuration portion attach the same number, and omit explanation. In this embodiment, the aperture width 16c is formed in the middle of the **** board 16. That is, the **** board 16 has composition which connected the front side horizontal plate 16a fixed to the lower end of the lamina perpendicularis 15, and the backside horizontal plate 16b formed by separating this and the aperture width 16c with the suitable space.

[0041]next, drawing 10 - drawing 14 -- the [the 1st -] — in each embodiment of five, the size of a suppression-of-waves member is changed systematically, and the result of having calculated the pressure integral of the 50-m range from the tip of the large-sized floating body is shown in a wave period base (equivalent to drawing 5). Depth-of-water =20m, wave height =2m, a wave direction = it calculated as 0 times (a wave direction is in agreement with the longitudinal direction of a large-sized floating body). In each figure, the value of each part size of (b) used for this calculation is shown in (a). (c) and (d) are the calculation result.

[0042]OO** shows rough evaluation of the suppression-of-waves effect for every embodiment which these calculation results showed to the remarks column of (a). It turns out that the pressure integral value (wave legal force) is falling to a considerable grade compared with what does not have a suppression-of-waves member of this invention (graph of x seal) in any case. It has written in addition under drawing 10 - drawing 14 also about the feature of each embodiment.

[0043]

[Effect of the Invention]As explained above, since waves can be suppressed efficiently and agitation can be reduced also in a wide range wave period and a high wave according to claims 1, 2, and 4 according to this invention by the suppression-of-waves member provided in the large-sized floating body, without installing a stationary type breakwater etc. in ocean space, a wave-proof type large-sized floating body is realizable.

[0044]According to claim 6, an incident wave is crushed when passing the member which can let water flow, billow energy decreases it, and it can reduce the influence of the incident wave of the large-sized floating body containing a suppression-of-waves member.

[0045]According to claims 3 and 5, it is effective in the area of the deck of a large-sized floating body being expandable. In claim 3, the effect that a marine vessel etc. can be prevented from colliding is in the front end of a **** horizontal plate and a **** ramp.

[Translation done.]

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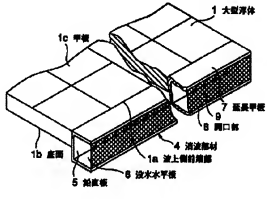
最終頁に続く

(54)【発明の名称】　耐波型大型浮体

(57)【要約】
【課題】大型浮体の波上側前端部に設けた消波部材によって効率良く消波でき、広範囲の波周期及び高い波においても動揺を低減できる耐波型大型浮体を提供することにある。
【解決手段】水上に浮かぶ耐波型大型浮体において、前記大型浮体１の波上側前端部１ａに、水面を貫通し、大型浮体１の底面１ｂより下方に延びる平板としての鉛直板５及びこの鉛直板５の下端部より前方に延びる没水水平板６を有する消波部材４を設けたことにある。



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【特許請求の範囲】

【請求項１】　水上に浮かぶ耐波型大型浮体において、前記大型浮体の波上側前端部に、水面を貫通し大型浮体の底面より下方に延びる平板及びその平板の下端部より前方に延びる没水水平板を有する消波部材を設けたことを特徴とする耐波型大型浮体。

【請求項２】　水上に浮かぶ耐波型大型浮体において、前記大型浮体の波上側前端部に、水面を貫通する大型浮体の底面より下方に延びる平板及びその平板の下端部より前方に向かって下り傾斜の没水傾斜板を有する消波部材を設けたことを特徴とする耐波型大型浮体。

【請求項３】　前記大型浮体は、波上側に延出する延長甲板を有し、この延長甲板の前端部と前記没水水平板または没水傾斜板の前端部との間を連水可能に連結したことを特徴とする請求項１または２記載の耐波型大型浮体。

【請求項４】　水上に浮かぶ耐波型大型浮体において、前記大型浮体の波上側前端部に、大型浮体の前端面と離間し、水面を貫通した大型浮体の底面より下方に延びる平板及びその平板の下端部より後方に延びる没水板を有する消波部材を設けたことを特徴とする耐波型大型浮体。

【請求項５】　前記大型浮体は、波上側に延出する延長甲板を有し、この延長甲板の前端部と水面を貫通し大型浮体の底面より下方に延びる平板の上端部とを連結し、前記大型浮体の波上側前端底部と没水板の後端部との間を連水可能に連結したことを特徴とする請求項４記載の耐波型大型浮体。

【請求項６】　前記連水可能に連結する部材は、網状部材、多孔板、スリット板または格子部材であることを特徴とする請求項３または５記載の耐波型大型浮体。

【請求項７】　前記没水水平板には、上下方向に貫通する開口が設けられていることを特徴とする請求項１記載の耐波型大型浮体。

【請求項８】　前記没水板には、上下方向に貫通する開口が設けられていることを特徴とする請求項４または５記載の耐波型大型浮体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、洋上に浮かぶ大型浮体構造物（以下、メガフロートという）、浮桟橋、浮倉庫等が入射波によって動揺するのを低減する耐波型大型浮体に関する。

【０００２】

【従来の技術】洋上に浮かぶメガフロートの開発が進められている。従来考えられていたメガフロートは、海域に固定式防波堤で静穏海域をつくり、その中に設置される箱型の浮体構造物であり、その内部には密閉された複数の浮き室が設けられ、フラットな甲板及びフラットな底面を備えている。

【０００３】従って、メガフロートは、海上空港（海上

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ヘリポートを含む）、海洋プラントバージまた将来的には海上都市など多目的である。

【０００４】図１５は、固定式防波堤を備えたメガフロートであり、海底ａに固定式防波堤ｂを施工し、静穏海域ｃをつくると共に、この静穏海域ｃに大型浮体ｅを浮かべ、それを囲むように係留杭ｄを設け、緩衝部材ｆを介して大型浮体ｅを係留する。大型浮体ｅは、例えば長さ１５００ｍ、幅５００ｍ、厚さ７ｍ、喫水２ｍであり、長さに比べて厚さが薄い構造である。

【０００５】そして、水深２０ｍで、波方向や波周期、大型浮体ｅの曲げ剛性を系統的に変えて波浪中弾性応答解析計算を行なったところ、限界波高が２ｍでも設計上厳しいことが判明した。

【０００６】また、固定式防波堤ｂは、水深が深くなると設置に莫大な費用が掛かり、また固定式防波堤ｂに代わって浮防波堤を設けることは船舶の接岸や荷役作業の邪魔になり、固定式防波堤ｂや浮防波堤がなくてもすむメガフロートが望まれている。

【０００７】コストや船舶等への影響を無くすことを考慮して固定式防波堤ｂや浮防波堤なしで成立させるためには、大型浮体ｅ自体に動揺低減対策を施して耐波性能を向上させる必要がある。まず、方法としては、大型浮体ｅに対する入射波を低減させるために、大型浮体ｅの波上側に消波構造体を付加することが考えられ、従来においては、図１６に示すように、大型浮体ｅの波上側前端部ｈに消波構造体ｇを固設した。

【０００８】従来の消波構造体ｇとしては、波を反射させたり、散乱させたり、また破砕等のメカニズムを利用して考えられたものであり、図１７（ａ）に示すカーテンウォール型、同図（ｂ）に示すタンク開口板型、同図（ｃ）に示すピーチ型等が知られている。

【０００９】

【発明が解決しようとする課題】　前述したカーテンウォール型は、短波長領域のみ有効であり、タンク開口板型や没水ピーチ型は、徐々に波を崩したり、破砕させるので、長波長領域まで有効である。しかし、十分な消波効果を得るためにはかなりの長さ、実験によれば波長に対して１／３位）が必要である。従って、仮に２００ｍの波長であると、７０～８０ｍの長さが必要となり、消波構造体が大型化すると共にコストアップの原因となる。

【００１０】この発明は、前記事情に着目してなされたもので、その目的とするところは、固定式防波堤等を設置することなく、大型浮体に設けた簡単な構造の消波部材によって効率良く消波でき、広範囲の波周期及び高い波においても動揺を低減できる耐波型大型浮体を提供することにある。

【００１１】

【課題を解決するための手段】この発明は、前記目的を達成するために、請求項１は、水上に浮かぶ耐波型大型

浮体において、前記大型浮体の波上側前端部に、水面を貫通し大型浮体の底面より下方に延びる平板及びこの平板の下端部より前方に延びる没水水平板を有する消波部材を設けたことを特徴とする。

【００１２】請求項１によれば、水上に浮かした状態で、波上側から波が進入すると、後に詳述するように、消波部材の没水水平板にかかる変動圧力（没水水平板の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体の前端部底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体前端部に作用する波の圧力積分値（波強制力）が小さくなり、動揺を低減できる。

【００１３】請求項２は、水上に浮かぶ耐波型大型浮体において、前記大型浮体の波上側前端部に、水面を貫通し大型浮体の底面より下方に延びる平板及びこの平板の下端部より前方に向かって下り傾斜の没水傾斜板を有する消波部材を設けたことを特徴とする。

【００１４】請求項２によれば、水上に浮かした状態で、波上側から波が進入すると、後に詳述するように、消波部材の没水平板にかかる変動圧力（没水平板の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体の前端部底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体前端部に作用する波の圧力積分値（波強制力）が小さくなり、動揺を低減できる。

【００１５】請求項３は、請求項１または２の前記大型浮体は、波上側に延出する延長甲板を有し、この延長甲板の前端部と前記没水水平板または没水傾斜板の前端部との間を通水可能に連結したことを特徴とする。

【００１６】請求項３によれば、大型浮体の甲板面積が広くなり有効に活用され、大型浮体の前方の没水平板に船舶等が衝突することが防止される。

【００１７】請求項４は、水上に浮かぶ耐波型大型浮体において、前記大型浮体の波上側前端部に、水面を貫通し大型浮体の前端面と離間し、大型浮体の底面より下方に延びる平板及びこの平板の下端部より後方に延びる没水板を有する消波部材を設けたことを特徴とする。

【００１８】請求項４によれば、水上に浮かした状態で、波上側から波が進入すると、後に詳述するように、消波部材の没水平板にかかる変動圧力（没水平板の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体の前端部底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体前端部に作用する波の圧力積分値（波強制力）が小さくなり、動揺を低減できる。

【００１９】請求項５は、請求項４の前記大型浮体は、波上側に延出する延長甲板を有し、この延長甲板の前端部と水面を貫通し大型浮体の底面より下方に延びる平板の上端部とを連結し、前記大型浮体の波上側前端底部と没水板の後端部との間を通水可能に連結したことを特徴とする。

【００２０】請求項５によれば、延長甲板によって大型浮体の甲板の面積が拡大される。

【００２１】請求項６は、請求項３または５の前記通水可能に連結する部材は、網状部材、多孔板、スリット板または格子部材であることを特徴とする。この場合は、さらに入射波が通水抵抗部材を通過するときに破砕され、波浪エネルギが減衰される。

【００２２】請求項７は、請求項１の前記没水水平板には、上下方向に貫通する開口が設けられていることを特徴とする。

【００２３】請求項８は、請求項４または５の前記没水板には、上下方向に貫通する開口が設けられていることを特徴とする。

【００２４】

【発明の実施の形態】以下、この発明の各実施の形態を図面に基づいて説明する。

【００２５】図１及び図２は第１の実施形態を示す。図１及び図２は超大型浮体式海洋構造物（以下、メガフロートという）を構成する大型浮体１を示し、この大型浮体１は、例えば鋼板によって直方体形状に構成し、内部には密閉された複数の浮き室（図示しない）が設けられている。そして、浮き室が発生する浮力によって大型浮体１は浮上に浮かんでいる。なお、２は大型浮体１の喫水線を示し、３は波の方向を示す。

【００２６】大型浮体１の波上側前端部１ａには大型浮体１の全幅に亘って耐波構造物としての例えば鋼板製の消波部材４が垂設されている。この消波部材４は、水面を貫通し大型浮体１の底面１ｂより下方に延びる平板としての鉛直板５と、この鉛直板５の下端部より一体に前方（波上側）に延びる没水平板としての没水水平板６とから略Ｌ型に構成されている。前記鉛直板５は、多少前後に傾いてもよい。また、この鉛直板５が大型浮体１の前端板と重なる部分については前端板で代用することも可能で、その場合は大型浮体１の下面から鉛直板５が垂下しているように見えるが趣旨は同じである。

【００２７】さらに、鉛直板５の上端部には大型浮体１の甲板１ｃと同一平面上で、波上側に水平に延出する延長甲板７が設けられ、鉛直板５及び没水水平板６とによって略コ字状に構成され、前端部には開口部８が設けられている。そして、この開口部８には延長甲板７の前端部と没水水平板６の前端部とに固定された通水可能な部材９が設けられている。この通水可能な部材９は、適当間隔に配設された支柱、網状部材、多孔板、スリット板または格子部材であり、海水は通過する。

【００２８】前述のように構成された消波部材４を備えた大型浮体１によれば、水上に浮かした状態で、波上側から波が進入すると、消波部材４の没水水平板６にかかる変動圧力（没水水平板６の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体１の前端部１ａの底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体１の前端部に作用する波の圧力積分値（波

強制力）が小さくなり、動揺を低減できる。

【００２９】しかも、波長に対して１／１０程度の長さで有効であり、仮に波長が２００ｍであるとすると、２０ｍ程度の長さで十分であり、消波部材４の小型化を図ることができ、コストダウンを図ることができる。

【００３０】また、本実施形態において、通水可能な部材９を網状部材、多孔板、スリット板、格子部材等で構成すると、入射波は通水可能な部材９を通過するときに破砕され、波浪エネルギが減衰され、消波部材４を含む大型浮体１の入射波の影響を低減できる。

【００３１】また、本実施形態においては、消波部材４に延長甲板７が設けられているため、大型浮体１の甲板１ｃの面積を拡大でき、船舶等が没水水平板６に衝突するのを防ぐ効果がある。しかし、延長甲板７は消波作用に直接作用するものではなく、省略してもよい。すなわち、消波性能的には消波部材４は、鉛直板５と没水水平板６とからなるＬ型構造であればよい。

【００３２】図３は大型浮体の前端（波上側）からの距離と大型浮体に加わる変動圧力振幅分布との関係を示すグラフである。グラフ中（×）は消波部材を有しない大型浮体であり、（○）はこの発明のＬ型の消波部材４を備えた大型浮体１である。（横軸のマイナス部分は消波部材）このグラフから明らかのように、大型浮体だけのものは、前端に大きな圧力が加わり、前端から離れるに従って徐々に減少するが僅かである。Ｌ型の消波部材４を備えた大型浮体１は、消波部材４に大きな圧力が加わるが、大型浮体１の前端に加わる圧力は１／２程度となることが判る。図４は圧力変動の位相分布を示したグラフであり、大型浮体１と消波部材４の圧力変動の位相が逆転していることが判る。

【００３３】さらに、図５は大型浮体１の前端から５０ｍまでの圧力積分値を波周期ベースで示したもので、消波部材４の没水水平板６にかかる変動圧力（没水水平板６の下面圧から上面圧を引いた値）と大型浮体１の前端部底面にかかる変動圧力が逆位相になり、互いに相殺するため、大型浮体１前端部に加わる圧力積分値（波強制力）が特に長周期側において大幅に低下されることが判る。

【００３４】図６は第２の実施形態を示し、第１の実施形態と同一構成部分は同一番号を付して説明を省略する。本実施形態の傾斜型の消波部材１１は、大型浮体１の波上側前端部１ａに、水面を貫通し大型浮体１の底面１ｂより下方に延びる鉛直板１２と、この鉛直板１２の下端部より前方に向かって下り傾斜の没水傾斜板１３とから構成されている。

【００３５】本実施形態の消波部材１１を備えた大型浮体１によれば、水上に浮かした状態で、波上側から波が進入すると、消波部材１１の没水傾斜板１３にかかる変動圧力（没水傾斜板１３の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体１の前端部１ａの底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体１前端部に作用する波の圧力積分値（波強制力）が小さくなり、動揺を低減できる。

【００３６】図７は第３の実施形態を示し、第１の実施形態と同一構成部分は同一番号を付して説明を省略する。本実施形態の逆Ｌ型の消波部材１４は、大型浮体１の波上側前端部１ａから波上側に向かって延出する延長甲板７の前端部から垂下され、大型浮体１の前端面と離間し、大型浮体１の底面１ｂより下方に延びる鉛直板１５と、この鉛直板１５の下端部より後方に延びる没水板１６とから構成されている。そして、没水板１６の後端部と大型浮体１の前端部１ａの下端角部との間には通水可能な部材１７が設けられている。

【００３７】従って、本実施形態の消波部材１４を備えた大型浮体１によれば、水上に浮かした状態で、波上側から波が進入すると、消波部材１４の没水板１６にかかる変動圧力（没水板１６の下面にかかる圧力から上面にかかる圧力を引いた値）と大型浮体１の前端部１ａの底面にかかる変動圧力が逆位相になり互いに相殺するため、大型浮体１前端部に作用する波の圧力積分値（波強制力）が小さくなり、動揺を低減できる。

【００３８】なお、本実施形態においては、鉛直板１５の下端から直角に折曲した形状で、後方に延びる没水板１６を設けたが、鉛直板１５の下端部を没水板１６の下面より下方に突出する構造であってもよい。

【００３９】図８は第４の実施形態を示し、第１の実施形態と同一構成部分は同一番号を付して説明を省略する。本実施形態においては、没水水平板６の途中に開口幅６ｃが形成されている。すなわち、没水水平板６は鉛直板５の下端に固定された後側水平板６ａと、これと開口幅６ｃを隔てて設けられた前側水平板６ｂとを適当間隔で連結した構成となっている。

【００４０】図９は第５の実施形態を示し、第３の実施形態と同一構成部分は同一番号を付して説明を省略する。本実施形態においては、没水板１６の途中に開口幅１６ｃが形成されている。すなわち、没水板１６は鉛直板１５の下端に固定された前側水平板１６ａと、これと開口幅１６ｃを隔てて設けられた後側水平板１６ｂとを適当間隔で連結した構成となっている。

【００４１】次に、図１０～図１４に第１～第５の各実施形態において、消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を波周期ベースに示す（図５に相当）。なお、水深＝２０ｍ，波高＝２ｍ，波方向＝０度（波方向が大型浮体の長手方向と一致）として計算した。各図において、本計算に用いた（ｂ）の各部寸法の値を（ａ）に示す。

（ｃ）（ｄ）は、その計算結果である。

【００４２】これらの計算結果から分かった各実施形態毎の消波効果の大まかな評価を（ａ）の備考欄に◎○△で示す。いずれのケースでも本発明の消波部材を有しな

いもの（×印のグラフ）に比べ相当程度に圧力積分値（波強制力）が低下していることが分かる。なお、各実施形態の特徴についても、図１０～図１４の下方に付記している。

【００４３】

【発明の効果】以上説明したように、この発明によれば、請求項１，２及び４によれば、海域に固定式防波堤等を設置することなく、大型浮体に設けた消波部材によって効率良く消波でき、広範囲の波周期及び高い波においても動揺を低減できるので、耐波型の大型浮体を実現できる。

【００４４】請求項６によれば、入射波は通水可能な部材を通過するときに破砕され、波浪エネルギが減衰され、消波部材を含む大型浮体の入射波の影響を低減できる。

【００４５】請求項３，５によれば、大型浮体の甲板の面積を拡大できるという効果がある。さらに、請求項３では没水水平板、没水傾斜板の前端に船舶等が衝突するのを防止できるという効果もある。

【図面の簡単な説明】

【図１】この発明の第１の実施形態の耐波型大型浮体の一部を示す斜視図。

【図２】同実施形態の消波部材の側面図。

【図３】同実施形態の大型浮体の前端からの距離と変動圧力振幅分布の関係を示すグラフ。

【図４】同実施形態の圧力変動位相分布を示すグラフ。

【図５】同実施形態の大型浮体の前端から５０ｍまでの圧力積分値を波周期ベースに示すグラフ。

【図６】この発明の第２の実施形態を示す傾斜型の消波部材の側面図。

【図７】この発明の第３の実施形態を示す逆Ｌ型の消波部材の側面図。

＊【図８】この発明の第４の実施形態を示す消波部材の側面図。

【図９】この発明の第５の実施形態を示す消波部材の側面図。

【図１０】Ｌ型の消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を示す図。

【図１１】傾斜板型の消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を示す図。

【図１２】逆Ｌ型の消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を示す図。

【図１３】穴開き逆Ｌ型の消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を示す図。

【図１４】穴開き逆Ｌ型の消波部材の寸法を系統的に変えて、大型浮体の先端から５０ｍ範囲の圧力積分を計算した結果を示す図。

【図１５】固定式防波堤を備えたメガフロートを示す側面図。

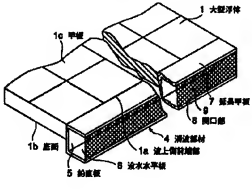
【図１６】消波構造体を固設したメガフロートの側面図。

【図１７】（ａ）～（ｃ）は従来の消波構造体の側面図。

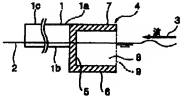
【符号の説明】

1…大型浮体
4…消波部材
5…鉛直板（平板）
6…没水水平板
7…延長甲板
9…通水可能な部材

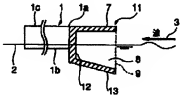
【図１】



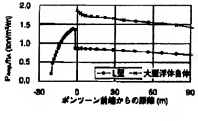
【図２】



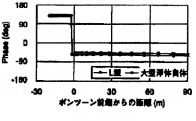
【図６】



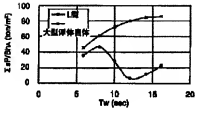
【図３】



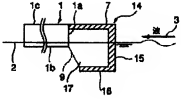
【図４】



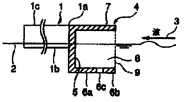
【図５】



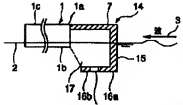
【図７】



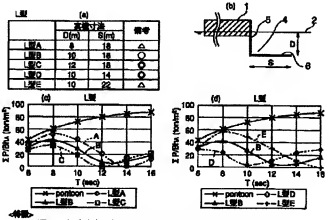
【図８】



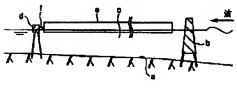
【図９】



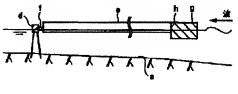
【図１０】



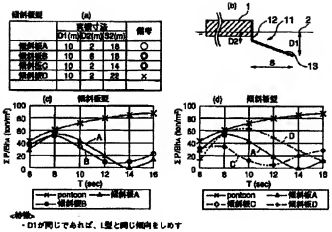
【図１５】



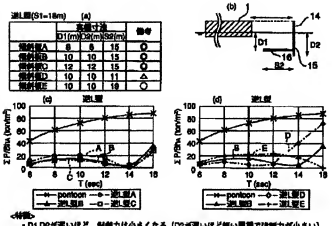
【図１８】



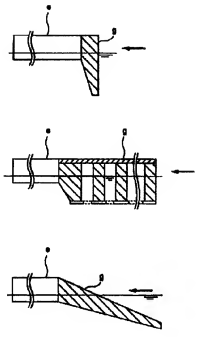
【図１１】


傾斜係留
(a)
改善寸法
D1(m) L2(m) S2(m)
備考
傾斜係留A 10 2 18 ○
傾斜係留B 10 6 18 ○
傾斜係留C 10 2 14 ○
傾斜係留D 10 2 22 ×
(b)
D2
D1
S
12
11
2
13
(c) 傾斜係留
(d) 傾斜係留
Σ P/BIA (ton/m²)
T (sec)
pontoon
傾斜係留A
傾斜係留B
傾斜係留C
傾斜係留D
<特徴>
・D1が同じであれば、L型と同じ傾向をしめす

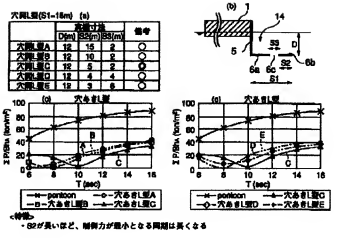
【図１２】


逆L型(S1=18m)
(a)
改善寸法
D1(m) L2(m) S2(m)
備考
傾斜係留A 8 8 16 ○
傾斜係留B 10 10 15 ○
傾斜係留C 12 12 15 ○
傾斜係留D 10 10 11 △
傾斜係留E 10 10 19 ○
(b)
D2
D1
S2
14
16
15
(c) 逆L型
(d) 逆L型
Σ P/BIA (ton/m²)
T (sec)
pontoon
逆L型A
逆L型B
逆L型C
逆L型D
逆L型E
<特徴>
・D1,D2が深いほど、制御力は小さくなる（D2が深いほど短い周期で波浪力が小さい）
・S2が長いほど、制御力が最小となる周期は長くなる

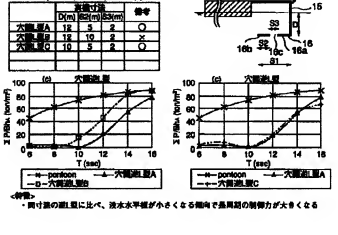
【図１７】


(a)
(b)
(c)

【図１３】



【図１４】



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